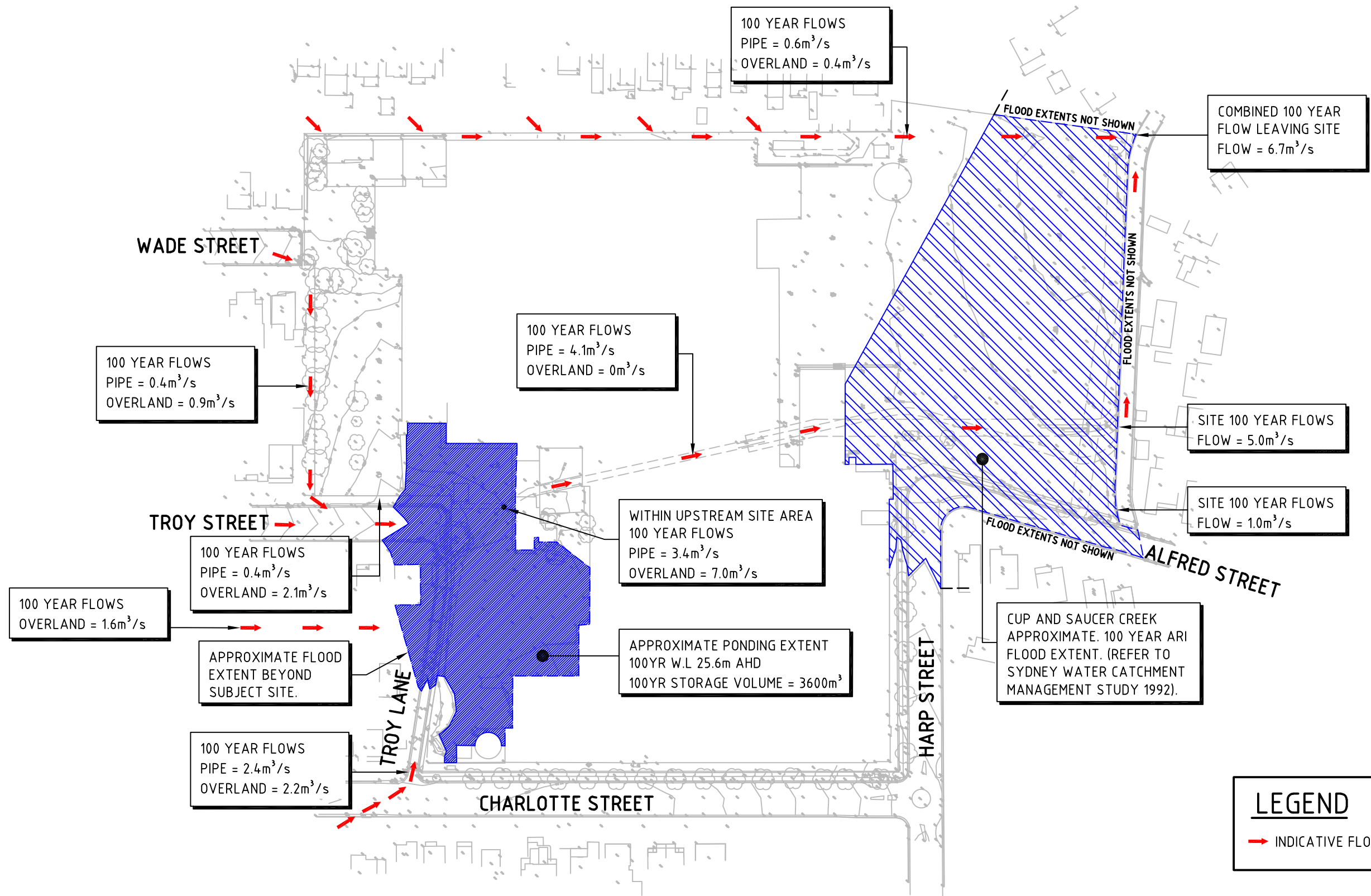
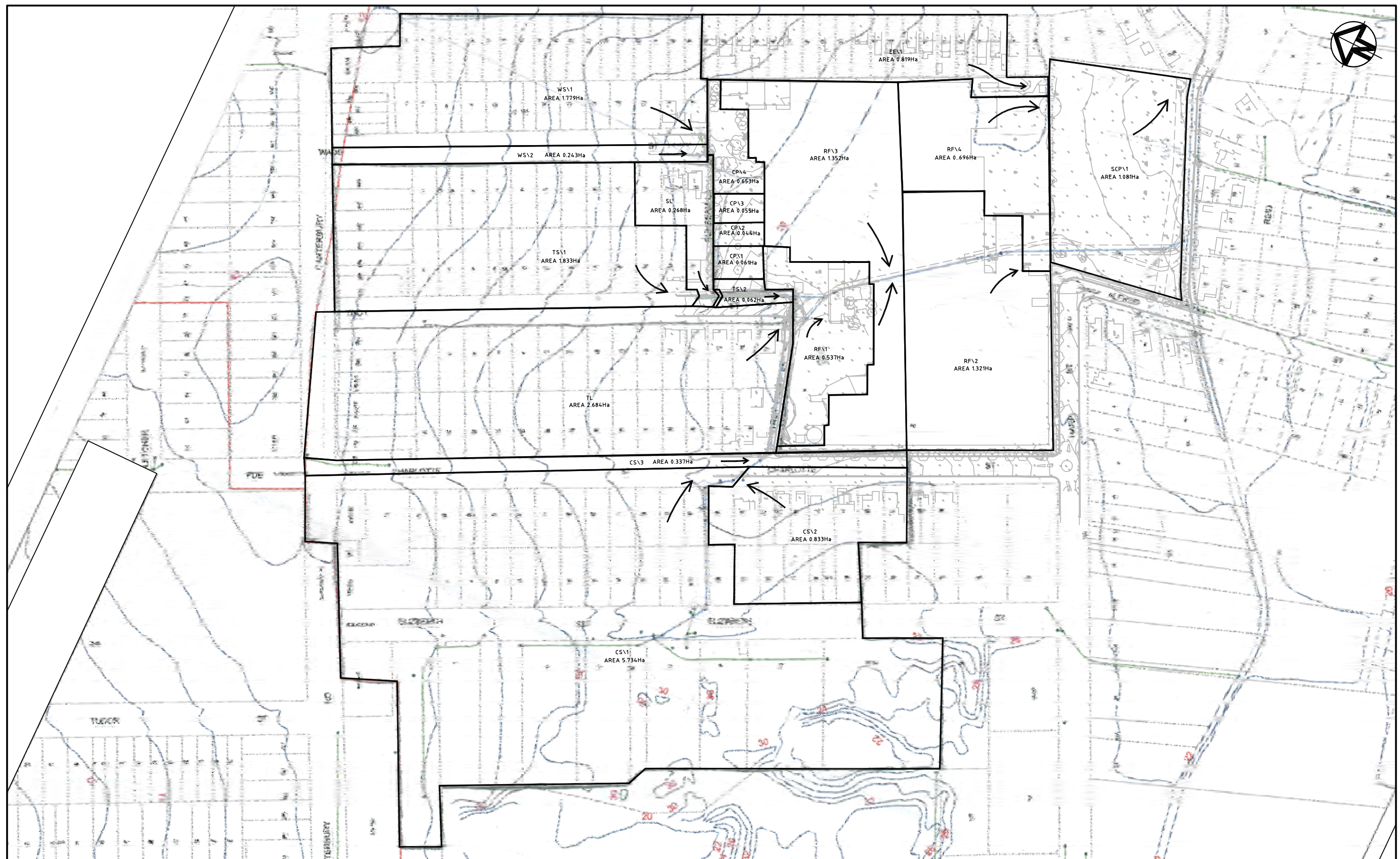
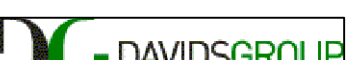




				PRELIMINARY NOT TO BE USED FOR CONSTRUCTION		Project CLEMTON PARK VILLAGE		 HYDER CONSULTING PTY LTD ABN 76 104 485 289 Level 5, 141 Walker St North Sydney NSW 2060 Australia Tel: +61 (0)2 8907 9000 Fax: +61 (0)2 8907 9001 www.hyderconsulting.com © Copyright reserved
Issue	Description	Date		Scales 1:1500	Current Issue Signatures Drawn NH Designed DC Height Datum AHD Grid	Title EXISTING FLOWS AND SITE PONDING/ FLOOD LEVELS	Drawing No. FIGURE 2—AA001875—01	
				Filename	FIGURE 2-AA001875-NSX-00-EXIST-FLOWS.dwg			Project No. Issue



				Client 		Status PRELIMINARY NOT TO BE USED FOR CONSTRUCTION Scales NTS Current Issue Signatures Drawn RD Original Size A3 Designed DC Height Datum AHD Checked GI Grid Approved GI File Name FIGURE 3-AA001875-NSX-00-EXIST-CATCHMENTS.dwg		Project CLEMTON PARK VILLAGE Title EXISTING CATCHMENTS		 HYDER CONSULTING PTY LTD ABN 76 104 485 289 Level 5, 141 Walker St North Sydney NSW 2060 Australia Tel: +61 (0)2 8907 9000 Fax: +61 (0)2 8907 9001 www.hyderconsulting.com © Copyright reserved	
Issue	Description	Date							Drawing No. FIGURE 3 — AA001875 — 01 Project No. Issue		

3.2 Proposed Stormwater System

3.2.1 Methodology

A separate rainfall runoff model (using DRAINS software) was developed to facilitate concept pit and conduit design, and to determine street flows regimes for the proposed area. The proposed layout is shown in accompanying Drawing C002 – General Arrangement Plan.

This DRAINS model includes similar parameters to those used in the abovementioned Existing Condition DRAINS model.

3.2.2 Site Catchment

The proposed stormwater drainage system is to incorporate discharge from the existing upstream catchment previously discussed in this report.

The proposed site catchments, including roads and buildings are shown in the accompanying Drawing C065 – Catchment Plan.

3.2.3 Pipe Network

The in ground drainage system is designed to cater for the 10 year ARI storm event. An overland flow system is provided for run-off in excess of the capacity of the pipe system. Where possible, the overland flow was kept to a velocity versus depth ($V \times D$) ratio of 0.4 (refer to discussion in results section 3.2.5).

The pipe system along New Alfred Street and New Harp Street are designed to cater for the 100 year ARI storm to avoid overland flows entering Alfred Street downstream of the site. This will replicate the existing condition.

Proposed connections to the existing Sydney Water stormwater channel are at the same locations as existing connections. This is to be achieved by the provision of surcharge pits on the proposed stormwater systems located just upstream of channel.

Blockage factors for inlet pits are assumed in the modelling in accordance Australian Rainfall and Runoff. For on-grade kerb inlet pits a blockage of 20% has been applied. For kerb inlet pits in a low point (sag) a blockage of 50% has been applied.

3.2.4 Detention Storage Requirements

Design Philosophy

To determine the total detention required for the site two criteria were considered:

- Provision of on-site detention (OSD) to the internal catchments based on the Canterbury Council design guidelines.
- No increase in peak flows out of the site (including external catchments).

Internal

Council requires that the Permissible Site Discharge (PSD) should be limited to 150 litres per second per hectare.

To assess the required OSD volume and discharge configuration DRAINS software has been used to model catchment flows for the proposed Precincts. The Table 1 below summarises the results:

Table 1: OSD Minimum Volume Required

Precinct	Catchment Area (ha)	Site Flow (m ³ /s)		Volume Required (m ³)
		Uncontrolled	OSD	
A	1.4	0.96	0.21	800
B	0.4	0.25	0.06	215
C	1.3	0.83	0.20	650
E	1.0	0.68	0.15	520
F	0.5	0.33	0.08	245

* For precinct location refer Appendix C .

The OSD volume and discharge requirements were determined by modelling the 100 year ARI storm for all durations ranging from the 5 minute to 4.5 hours.

External

As it is the intent of this development to match the existing flows crossing the site, the existing above ground storage is required to be replicated. Therefore, in addition to the calculated OSD volumes the two tanks located at the Precincts A and C were resized to accommodate the additional volume necessary to reproduce current condition.

The two tanks shown in Drawings C025 and C027, were combined into a two cell tank with total a volume of 5650 m³ at RL 25.0 mAHD. The invert level of the tank is set to be no lower than RL 22.5 mAHD.

3.2.5 Results

The DRAINS model indicates 10 year ARI minor street system capacities, as required by Council guidelines, are achieved. The pipe sizes and long sections are indicated in accompanying Drawings C045 to C047

The DRAINS model has also been run for 100 year ARI flows, with the results summarised in Figure 5 and indicating that the system along New Alfred St. and New Harp Street will safely convey flows complying with Council guidelines for the major (overland flow) street system. Street velocity versus depth ratio do not exceed 0.4 in most of the roads with the exception of New Troy Street between Charlotte Street and New Alfred Street. Due to existing pipe and pit system upstream of that point it is predicted that around 2 m³/s will enter the site overland at that location which alone would exceed a VxD of 0.4. At the sag point in New Troy Street an inlet system is proposed to capture this flow. Ponding depth at that location would be approximately 0.4m (for the assessed sag pit blockage of 50%).

The 100 year ARI flows from the proposed development were compared to the existing situation showing significant reduction in all durations, from 5 minutes to 4.5 hour storm. A comparison of the flows is shown in Figure 4.

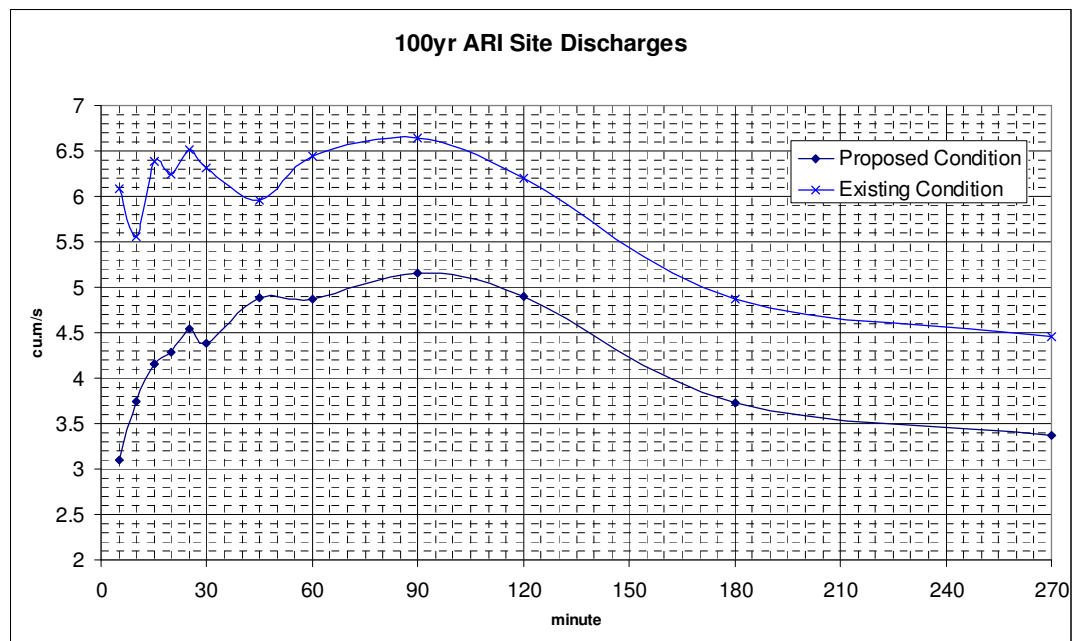
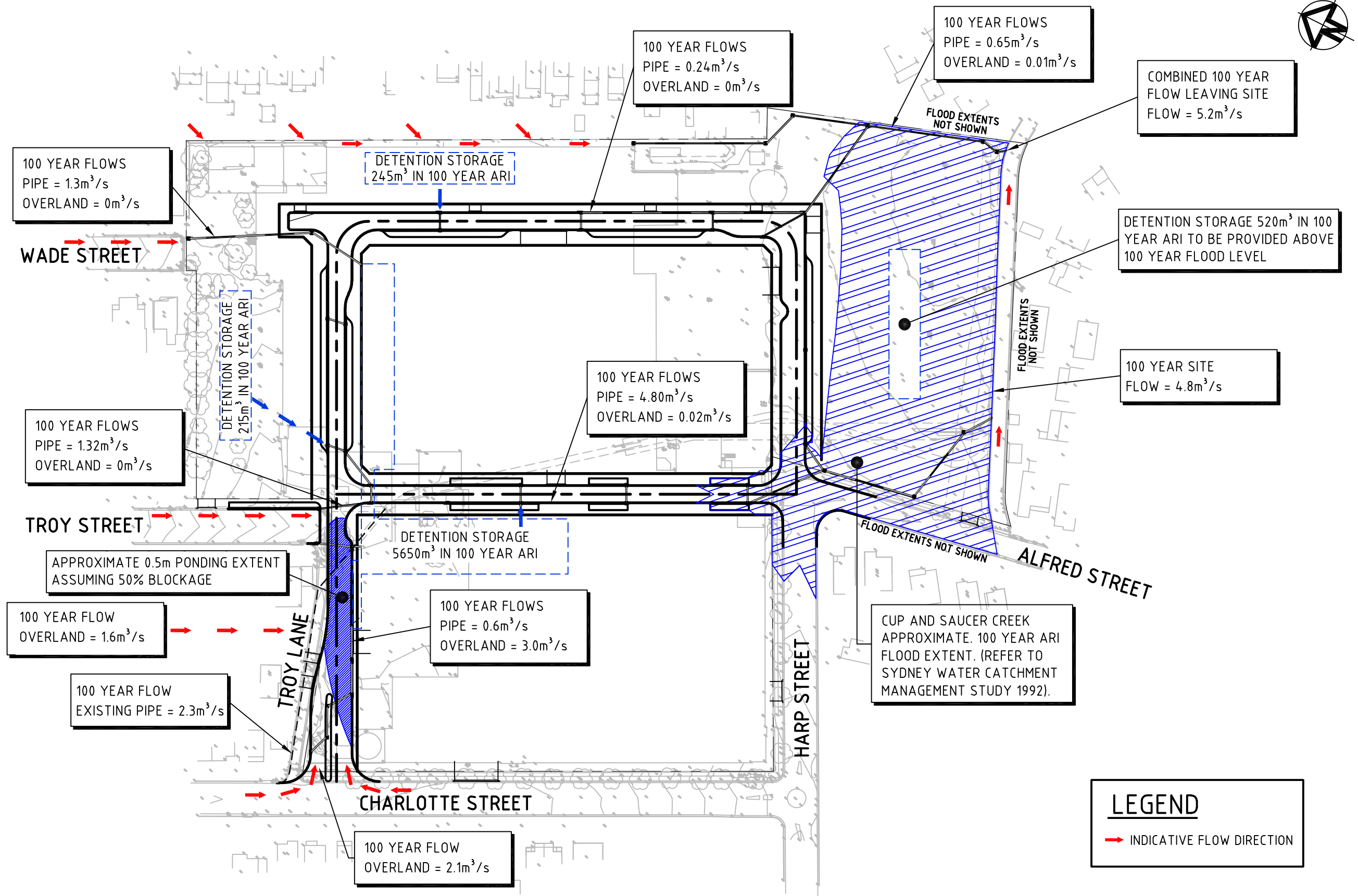


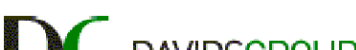
Figure 4 – 100 Year ARI Flow Comparison

The DRAINS DA area model results are included in Appendix D.

3.2.6 Climate Change Considerations

In general two climate change features have the potential to impact on flooding – sea level rise, rainfall intensity and frequency. With the proximity of the site being above RL19mAHD it is not expected to be impacted by predicted climate change sea level rise within the design life of the redevelopment project. With respect to design rainfall patterns (intensity, frequency, and duration) best practice is considered to be use of Australian Rainfall and Runoff (2000) methodology which has been adopted for design rainfall intensities and temporal patterns.



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			Scales 1:1500	Current Issue Signatures Drawn NH Designed DC Checked GI Approved GI		Title POST REDEVELOPMENT FLOWS AND SITE PONDING/ FLOOD LEVELS		Drawing No. Project No. Issue	
Issue Description Date		FIGURE 5-AA001875-NSX-00-POST_REDEVELOPMENT_FLOWS.dwg		FIGURE 5-AA001875-NSX-00-POST_REDEVELOPMENT_FLOWS.dwg		FIGURE 5— AA001875— 01			
50mm on Original		Date Plotted: 10 Oct 2008 - 11:50AM File Name: F:\AA001875\B-CAD\C-Civil\B-Sketches\FIGURE 5-AA001875-NSX-00-POST_REDEVELOPMENT_FLOWS.dwg							

4 Cup & Saucer Creek Flood Management

As part of this management assessment and in support the submission of the Concept Plan for the site and the Project Application for Lot 1 and Lot 3, relevant flood information has been obtained from Sydney Water with respect to the existing stormwater channel that runs along the southern eastern site boundary.

It is noted that although the Section 149 Planning Certificate, dated 4 April 2001 states that “Council’s records indicate that the land is not subject to flooding”, the Sydney Water report (1992) indicates significant flooding through the site (discussed below) as a result of limited capacity of the Cup & Saucer Creek system.

4.1 Existing Condition

Sydney Water provided a report that examines flooding issues along Cup & Saucer Creek. According to the Sydney Water report, the stormwater channel has approximately 2 to 5 year ARI capacity within the vicinity of the site, and the 100 year ARI flood levels along the creek extends through the site varying from approximately 22.4 mAHD at the upstream of the Alfred St. bridge to approximately 20.6 mAHD at the eastern (downstream) side of the site.

The provided levels were interpolated to approximate the 100 year flood extent indicated in Figure 2. Based on the interpolated 100 year flood levels it is noted that Alfred St. is subject to inundation with water depths in the street varying from approximately 0.5m at the intersection with Harp St. to 1.2m at the Alfred St. bridge over the channel.

4.2 Proposed Redevelopment Condition

A local flood study has not been conducted on the Cup & Saucer Creek channel as part of the Concept Plan investigation. The current assessment of the impact of the proposed development to the flooding regime is restricted to:

- The stormwater modelling (discussed in section 3.2 of this report) which indicates that there is no increase in flows from the site discharging into the channel.
- A storage volume balance to meet the requirement of the Sydney Water Feasibility Letter (26/09/2008) which states that “reasonable care should be taken to ensure that local flooding storage is not unreasonably diminished”. With respect to this matter, the proposed New Harp Street is to be a fill formation within the current 100 year flood extent. The 100 year flooding storage volume (based on the Sydney Water 100 year ARI flood levels) is approximately 5400m³.

Reshaping of the within site areas subject to this flooding provides a storage volume of approximately 6500 m³ (refer accompanying civil drawings) and is considered to comply with the Sydney Water flood storage requirement.

4.3 Redevelopment Issues and Requirements

4.3.1 New Troy Street

Overland flows approach New Troy Street from the northern residential area, and west from Charlotte Street. These flows are indicated in Figure 5 and exceed safe velocity depth requirements, with a ponding depth of up to approximately 0.5m in the 100 year ARI event. The proposed New Troy Street drainage system captures as much flow as practically possible. The existing 1050mm diameter stormwater system (along the existing Troy Street alignment) is to be retained. Any future Council upgrade to reduce overland flows (from the northern residential area and west from Charlotte Street) would be piped directly into the proposed underground detention storage within the site.

4.3.2 New Alfred and New Harp Street

New Alfred St. and New Harp St. connect to the existing roads at the intersection of Alfred and Harp St which as stated previously is inundated to a depth of approximately 0.5m in the 100 year ARI as a result of Cup & Saucer Creek flood conditions. The Cup & Saucer Creek system capacity and flood regimes on neighbouring property are not impacted by the proposed redevelopment.

4.3.3 Lot 5 (South of New Harp Street)

The 100 year ARI Cup & Saucer Creek flood depths in this area are up to approximately 1.2m deep which will need to be taken into account in the detailed design of future development in this portion of the site.

It is noted that the Sydney Water Feasibility Letter (26/09/2008) requires additional investigation in the form of a Flood Study and Floodplain Risk Management Study to determine the potential impact of the proposed development on the local flood regime. Such a study should be conducted prior to issue of Construction Certificate of the subject portion of the development when further details of the proposed construction in the future lot adjacent to the channel are available.

4.3.4 General Development Criteria

Redevelopment of the site compatible with flooding conditions is considered achievable, noting the issues described above, and should be based on the NSW Floodplain Development Manual (2005) and Canterbury City Council guidelines.

Key flood management requirements for redevelopment of the site include:

- habitable floor levels are to be a minimum of 0.5m above the Council's 'Standard Flood Level' (typically 100 year ARI flood levels);
- ensuring that the development does not increase the potential flood hazard or flood damage to other properties or adversely affect them in any way during times of flooding. This may require further investigation of Lot 5, immediately adjacent to the stormwater channel as outlined in the Sydney Water Feasibility Letter;
- development of a Flood Emergency and Evacuation Plan based on the final configuration of the proposed construction in the affected areas. A sample Plan is included as in Appendix F.